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HIST

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HIST is a Fortran-callable package which makes one-dimensional and two-dimensional histograms for a line-printer or non-graphic terminal.

**Working Paper**

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## One-dimensional Histograms

HIST1 makes histograms for lineprinter or a terminal. The output is formatted so you can read it without turning the paper on its side, and you can control the amount of information that is printed with it.

No page eject is written, so you should write a line containing a carriage control '1' just before calling HIST1. This would normally be the title line for the plot.

The full calling sequence is

```
CALL HIST1(NBINS,XMIN,XMAX,HARRAY,EARRAY,CARRAY)
```

**NBINS**        the number of bins (columns) in the histogram.

**XMIN**        the value of the abscissa at the left edge.

**XMAX**        the value of the abscissa at the right edge.

**HARRAY**        an array with NBINS elements,  
(REAL\*4        containing the numbers used for the bin  
  ARRAY)        contents.

**EARRAY**        an array with NBINS elements,  
(REAL\*4        containing the numbers used for the error  
  ARRAY)        bar half-widths.

**CARRAY**        an array with NBINS elements,  
(REAL\*4        containing the numbers used for the  
  ARRAY)        superimposed curve.

The parameters may be REAL\*4 or INTEGER\*4. The arrays must be REAL\*4.

Labels are put every ten bins, using XMIN, XMIN+10\*D, XMIN+20\*D, etc., where  $D = (XMAX - XMIN) / NBINS$ . (This is the only use of XMIN and XMAX.)

### Optional Calling Sequences:

CARRAY, or EARRAY and CARRAY, may be omitted from the call, and the curve, or curve and error bars, will be omitted from the plot. For instance,

CALL HIST1(20,0.,1.,H)        would make a histogram.

CALL HIST1(20,0.,1.,H,DX)    would plot the points using H for the values, and DX for the error bars.

Dummy Arguments:

The error bars and/or curve may also be suppressed by substituting the value 'NCNE' for the corresponding argument, or by putting the value 'NONE' as the first element of the corresponding array. The histogram may also be suppressed, leaving only the curve. In this case, the error bars are meaningless. For instance,

CALL HIST1(20,0.,1.,'NCNE','NCNE',C) would plot  
only a curve.

CALL HIST1(20,0.,1.,H,'NCNE',C) would make the  
histogram and curve, with no error bars.

CALL HIST1(20,0.,1.,H,'NONE','NONE') would make a  
histogram.

Optional Output control

The basic input for HIST1 is in the calling sequence. There is also a common block containing information which you may change. The block is given by

COMMON /HISTCT/ CT(12)

CT is an array of 12 control values. (Type REAL\*4)

Word	Default	Meaning
CT(1)	40.	Number of lines in histogram. Negative or zero gives the default value.
(2)		Not used.
(3)		Not used.
(4)	-1.	Step size for ordinate. Positive gives step size. Negative or zero gives minimum step size. Thus, the default is to have steps as large as necessary, but no smaller than 1.
(5)	0.	Non-zero for logarithmic ordinate scaling.
(6)	0.	Non-zero to normalize the curve, so the sum of the curve values equals the sum of the hist values.
(7)	1.	Non-zero to print the values in the hist bins.
(8)	0.	Non-zero to print cumulative totals of the hist bins.
(9)	0.	Non-zero to print the values of the curve.
(10)	0.	Non-zero to print cumulative totals of the curve values.
(11)	0.	Non-zero to print error values,
(12)	0.	Not used.

## Two-Dimensional Histograms

HIST2 makes 'scatter plots' for lineprinter or terminal. These are not true scatter plots, but two-dimensional histograms in which the contents of a doubly-dimensioned array are printed, one character per element. The number of elements (or 'bins') is set in the calling program, but there may be no more than 110 in the x-direction (across the page).

Row and column sums are printed along with the contents.

No page eject is written, so you should write a line containing a carriage control '1' just before calling HIST2. This would normally be the title line for the plot.

The calling sequence is

CALL HIST2 (ARRAY, NNB, NNX, NXBINS, XMIN, XMAX, NYBINS, YMIN, YMAX)  
A shortened sequence is not allowed.

ARRAY holds the values to be printed. The calling program should have the statement

DIMENSION ARRAY (nnx, nny),

where nnx is the number given for NNX, and nny is NYBINS or greater. If a floating point number is used, the value is truncated to provide the printed value, but the full value is used for the row and column sums. The character printed for each value is

negative or zero	blank
1	+
2-9	2-9
10	A
11-34	B-Y
35 or over	Z

NNB the number of bytes in each ARRAY element.  
1 if ARRAY is LOGICAL\*1  
2 if ARRAY is INTEGER\*2  
4 if ARRAY is REAL, INTEGER, REAL\*4, or INTEGER\*4  
8 if ARRAY is DOUBLE PRECISION, REAL\*8, or COMPLEX  
(Only the real part will be used for complex numbers.)

NNX the first dimension of ARRAY. Normally, this is the same as NXBINS. It may be greater than NXBINS, which will mean that some of the array elements are not used. It should not be less than NXBINS.

NXBINS the number of bins (columns) to print across the page. No more than 110 will be used.

XMIN is the x-value used for the left side of the plot when the x-axis labels are made.

XMAX is the x-value used for the right side of the plot when the x-axis labels are made. XMAX must not equal XMIN.

6

**NYBINS** the number of bins (rows) to print down the page. There is no internal limit to this number, although for more than about 50, you may want an ASP control card

```
    /*FORMAT PR,DDNAME=FT06F001,OVPI=OFF
to prevent spacing at the edge of the page.
```

**YMIN** is the y-value used for the bottom of the plot when the y-axis labels are made.

**YMAX** is the x-value used for the top of the plot when the y-axis labels are made. YMAX must not equal YMIN.

All of the parameters may be either REAL or INTEGER. The array may have any type, as given by NNB. This calling sequence is too long to be remembered easily. It may help to note that the first three arguments describe the array, the next three describe the x-axis, and the last three describe the y-axis.

#### Optional Superimposed Curve

A curve can be superimposed on the plot by defining a REAL FUNCTION HIST2F(X,Y). If the rectangle  $X_{MIN} < X < X_{MAX}$  and  $Y_{MIN} < Y < Y_{MAX}$  is split into two (not necessarily connected) regions in which  $HIST2F(X,Y) > 0$  and  $HIST2F(X,Y) < 0$ , a special character is put in each bin which is crossed by the boundary between the two regions, and which would otherwise be blank.

The values of X and Y at the corners of each blank bin are calculated using  $X_{MIN}$ ,  $X_{MAX}$ ,  $Y_{MIN}$ , and  $Y_{MAX}$ . The function is evaluated between two and four times for each blank bin. For no curve, HIST2F should supply a value which never changes sign, such as a non-zero constant. If the value 'NONE' is returned by HIST2F the first time it is called for a plot, it will not be called again for that plot. If the function is not supplied by the user, a dummy routine will be used.

Using themFrom a Standard Fortran Job

A loadmodule for these routines is in WYL.CG.RBC.LOADMODS(HIST1) with alias HIST2. Put a parameter LKEDLB1='WYL.CG.RBC.LOADMCDS' in your // EXEC FORT... or // EXEC MORT... statement, and the necessary routines will be loaded automatically.

From WATORV

Short jobs can benefit from the quick turnaround available with the WATFIV compiler running under ORVYL. This system is especially helpful in debugging and writing new code, because the WATFIV compiler will detect and clearly explain errors which the IBM compilers ignore. A deck, containing mostly object code generated by the Fortran H Extended compiler with OPT=2, is in WYL.CG.RBC.WATHIST (on CATALOG). Copy this dataset into your Fortran deck, before the \$DATA card. The WATORV (or WATFIV) loader will handle the rest.

Example

```

//ABCPLOTS JOB ABC$DE,TIME=(,15)
// EXEC FORIGCG,LKFDLE1='WYL.CG.RBC.LOADMODS'
//FOR1.SYSIN DD *
C TEST OF HIST1 AND HIST2
  COMMON /HISTCT/ CT(12)
C NOTE THAT THE ARRAYS HAVE BEEN DIMENSIONED LARGER
C THAN IS NECESSARY. '60' APPEARS IN THE CALL TO
C HIST2, BUT '30' AND '200' ARE NEVER USED.
  DIMENSION PARRAY(60,30),HARRAY(200),CARRAY(200)
  DIMENSION EARRAY(200)
C SET UP ARRAYS FOR 1-D HISTOGRAM TEST
  DO 10 I=1,50
    HARRAY(I)=FLOAT(I)
    EARRAY(I) = SQRT(HARRAY(I))
    CARRAY(I) = 50.+20.*SIN(FLOAT(I)*.1)
  10 CCONTINUE
C MAKE 1-D HISTOGRAMS.
  DO 20 I=1,2
    IF (I.EQ.1) GO TO 15
C SECOND TIME, SET PRINT FLAGS
    DO 12 J=7,11
  12 CT(J) = 1.
C AND LOG SCALE
    CT(5) = 1.
  15 CONTINUE
    WRITE(6,21)
  21 FORMAT(10H1HIST ONLY)
    CALL HIST1(50,0.,1.,HARRAY)
    WRITE(6,22)
  22 FORMAT(16H1HIST AND ERRORS)
    CALL HIST1(50,0.,1.,HARRAY,EARRAY)
    WRITE(6,23)
  23 FORMAT(10H1EVEBYECDY)
    CALL HIST1(50,0.,1.,HARRAY,EARRAY,CARRAY)
    WRITE(6,24)
  24 FORMAT(11H1CURVE ONLY)
    CALL HIST1(50,0.,1.,4HNCNE,4HNONE,CARRAY)
    CT(5)=1.
  20 CCONTINUE
C
C SET UP ARRAYS FOR 2-D HISTOGRAM TEST
  DO 50 I=1,40
    DO 40 J=1,20,2
      PARRAY(I,J)=I+J-5
      PARRAY(I,J+1)=0.
  40 CCONTINUE
  50 CONTINUE
C MAKE THE 2-D HISTOGRAM
  WRITE(6,60)
  60 FORMAT(27H1NOW THE 2-DIMENSIONAL PLOT)
  CALL HIST2(PARRAY,4,60,40,0.,1.,20,-10,10)
  STCP
  END
//

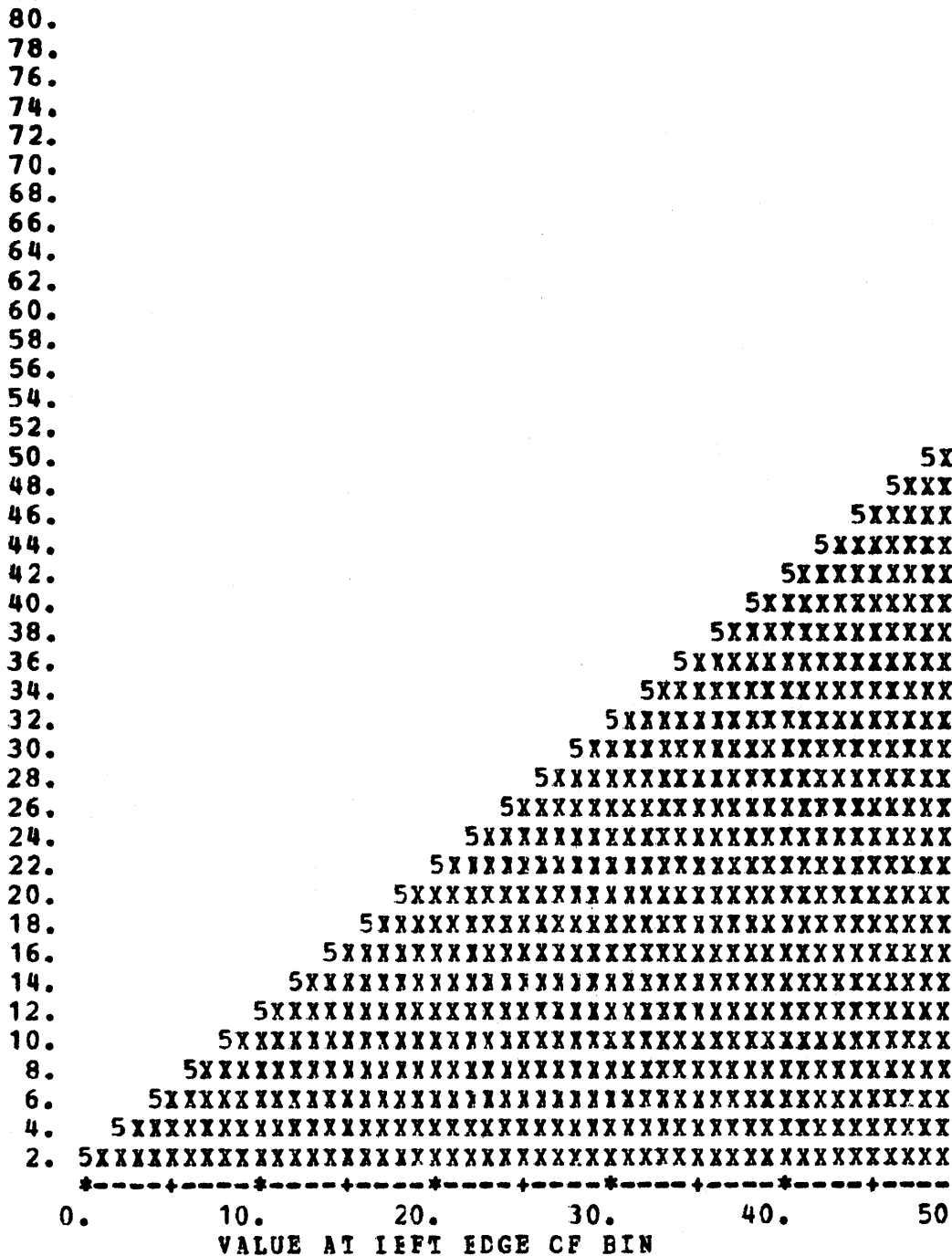
```



Output

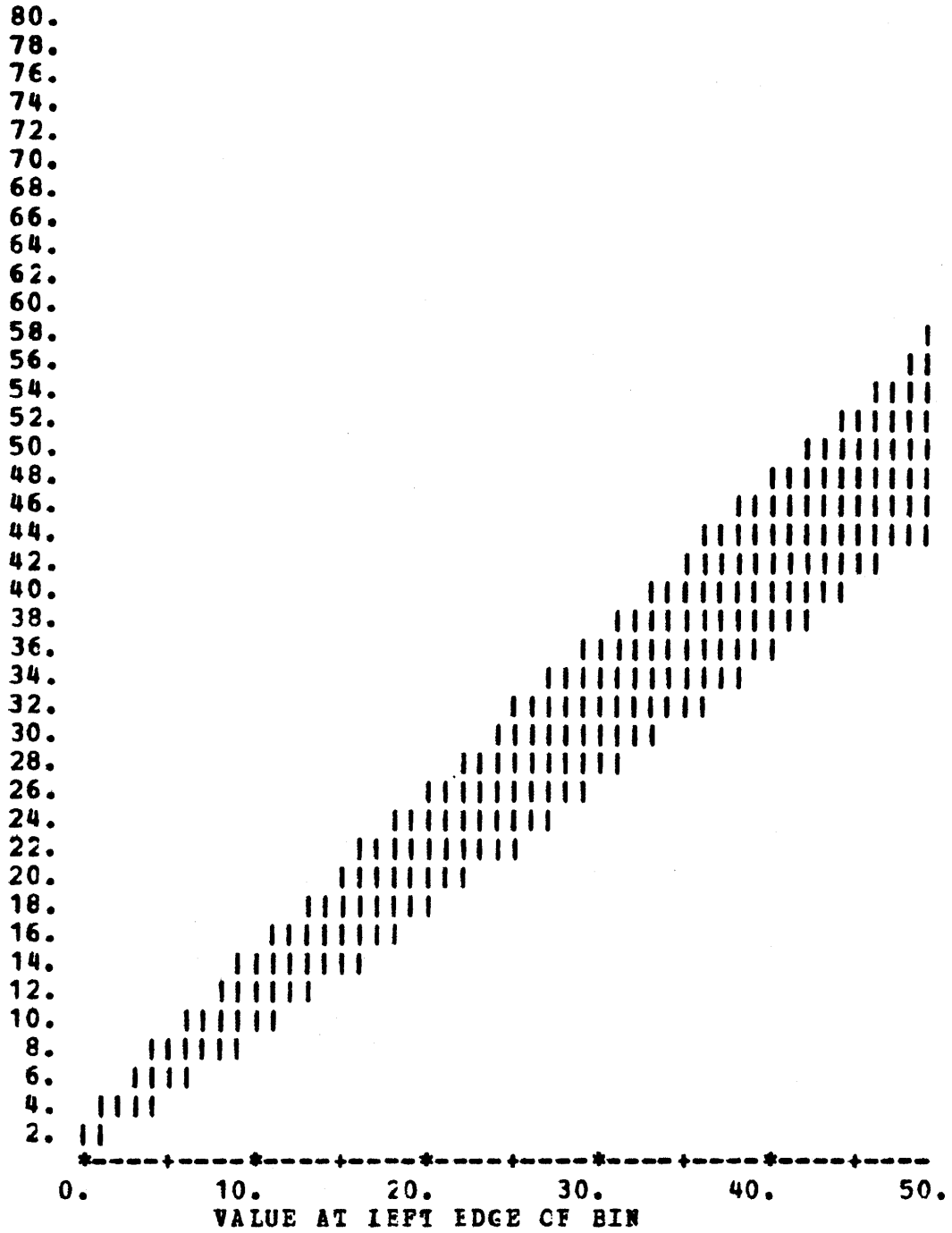
The output from this job is reproduced on the following pages.

HIST ONLY



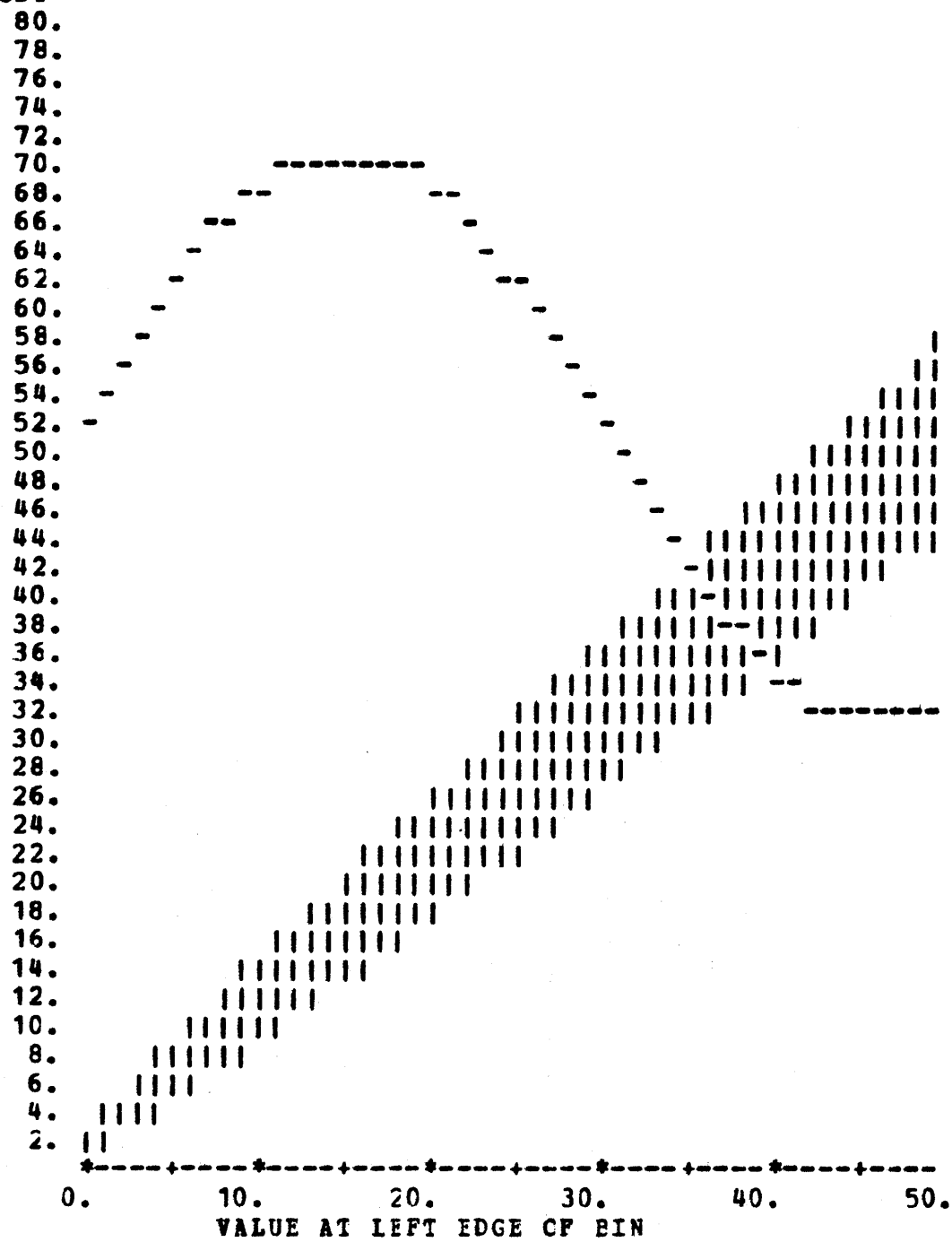
50 BINS LEFT EDGE 0. STEP 1.000E 00 RIGHT EDGE 5.000E 01  
 \* \* \* \* \*  
 CONTENTS 111111111222222222233333333334444444445  
 OF BINS 12345678901234567890123456789012345678901234567890

HIST AND ERRORS



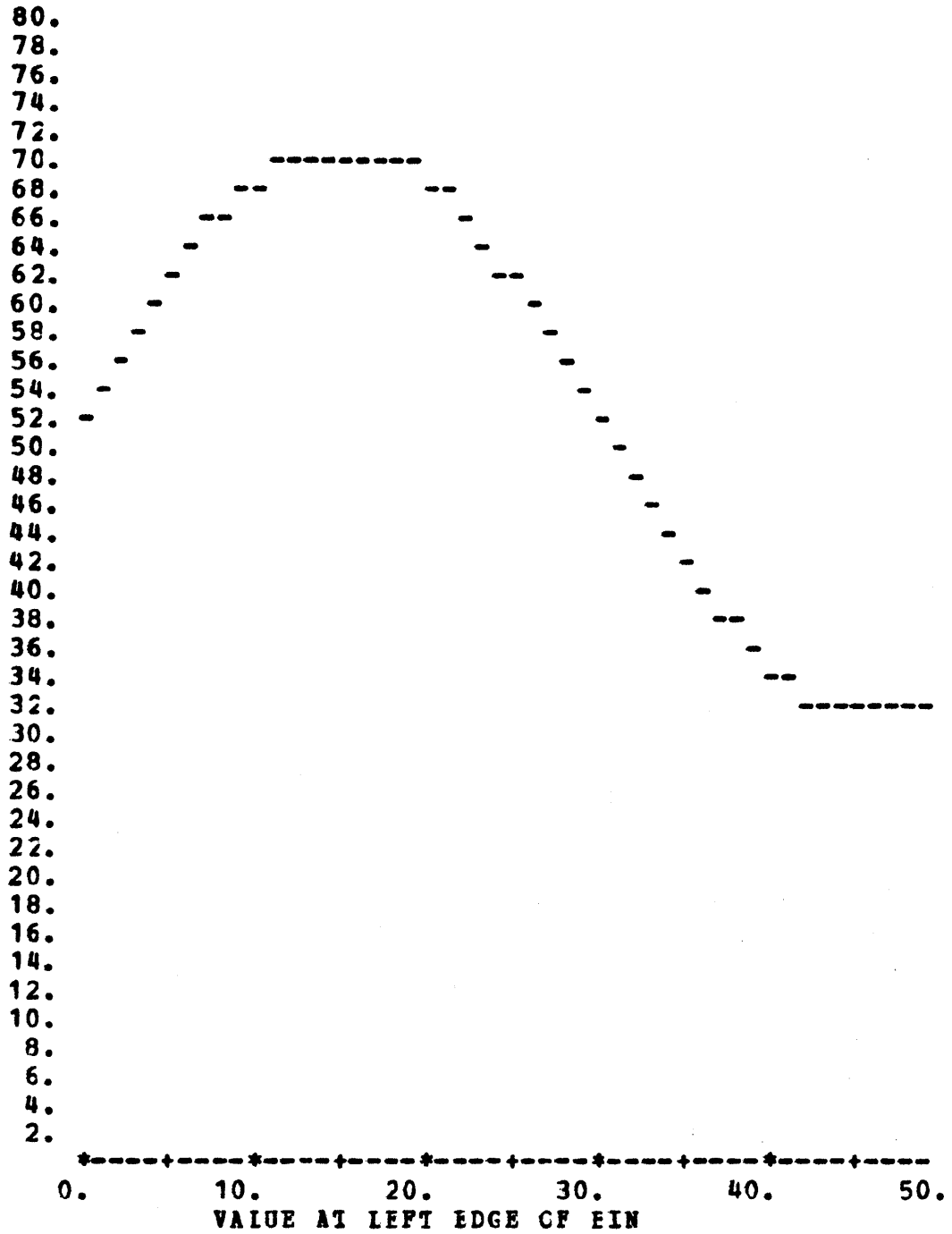
50 BINS LEFT EDGE 0. STEP 1.000E 00 RIGHT EDGE 5.000E 01  
 \* \* \* \* \*  
 CONTENTS 1111111111222222222233333333334444444445  
 OF BINS 12345678901234567890123456789012345678901234567890

EVERYBODY



50 BINS LEFT EDGE 0. STEP 1.000E 00 RIGHT EDGE 5.000E 01  
 \* \* \* \* \*  
 CONTENTS 1111111111222222222233333333334444444445  
 OF BINS 12345678901234567890123456789012345678901234567890

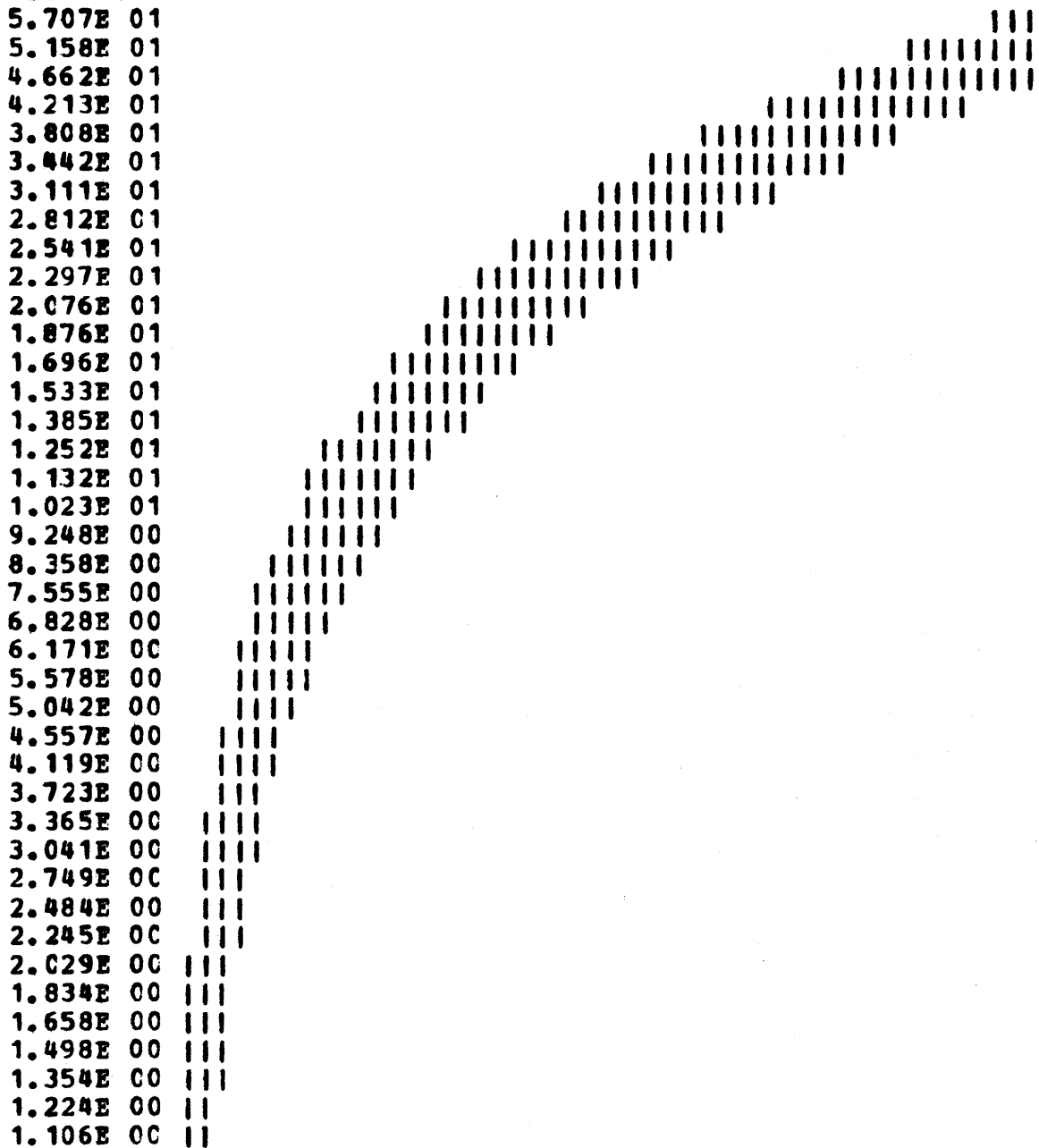
CURVE ONLY



50 BINS LEFT EDGE 0. STEP 1.000E 00 RIGHT EDGE 5.000E 01



HIST AND ERRORS



0. 10. 20. 30. 40. 50.  
 VALUE AT LEFT EDGE OF BIN

50 BINS LEFT EDGE 0. STEP 1.000E 00 RIGHT EDGE 5.000E 01

CONTENTS 111111111122222222223333333334444444445  
 OF BINS 12345678901234567890123456789012345678901234567890

CUMULATIVE TOTALS 1111112222333344445556677788999001122  
 OF BINS 11223456790235791357025703692693604826049382727  
 13605186556815063100136051865568150631001360518655

ERRORS 111222233333334444444455555555555666666666666677  
 (+-) 04702468013467801234567800123456789001234456778900

013034420616047024578999C9998765431086420853085207  
04206968027462303392306909625787516034553173826801





01303442061604702457899909998765431086420853085207  
04206968027462303392306909625787516034553173826801  
\* \* \* \* \*  
5555666666666666666666666666666655555444433333333333333  
13579124567899999988764310864208642197643210000000  
.....  
99975283688627998491219593577888889147286569410038  
97188984622470593728671061408233488506463676420752  
73089347794119013766404990805223594033544978962712  
\* \* \* \* \*

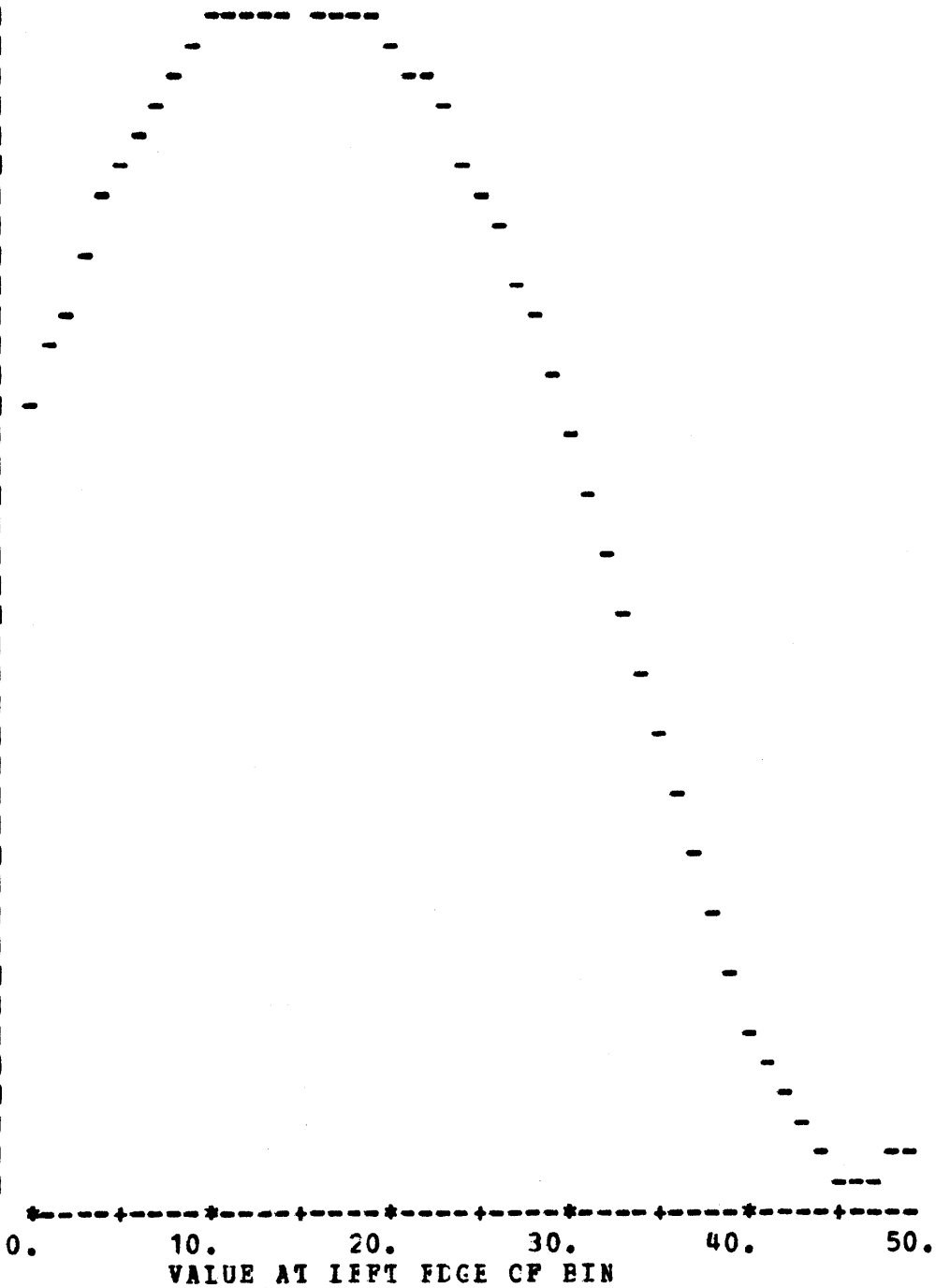
CURVE  
VALUES

CUMULATIVE  
TOTALS  
OF CURVE

111111111111111112222222222222222222  
1122344566788900122344566778899001122233344455566  
50627406306307418529529517394959493715825825814703  
2620913830E76666554296C46651690960354283791222234

CURVE ONLY

6.999E 01  
 6.765E 01  
 6.623E 01  
 6.485E 01  
 6.349E 01  
 6.216E 01  
 6.085E 01  
 5.958E 01  
 5.833E 01  
 5.711E 01  
 5.591E 01  
 5.474E 01  
 5.359E 01  
 5.247E 01  
 5.137E 01  
 5.029E 01  
 4.924E 01  
 4.821E 01  
 4.720E 01  
 4.621E 01  
 4.524E 01  
 4.429E 01  
 4.336E 01  
 4.245E 01  
 4.156E 01  
 4.069E 01  
 3.984E 01  
 3.901E 01  
 3.819E 01  
 3.739E 01  
 3.660E 01  
 3.584E 01  
 3.509E 01  
 3.435E 01  
 3.363E 01  
 3.293E 01  
 3.224E 01  
 3.156E 01  
 3.090E 01  
 3.025E 01



50 BINS LEFT EDGE 0. STEP 1.000E 00 RIGHT EDGE 5.000E 01  
 \* \* \* \* \*  
 CURVE 555556666666666666666666666666665555544444333333333333333  
 VALUES 13579124567899999988764310864208642197643210000000  
 .....  
 99975283688627998491219593577888889147286569410038  
 97188984622470553728671061408233488506463676420752  
 73089347794119013766404990805223594033544978962712  
 \* \* \* \* \*  
 CUMULATIVE 1111111111111111222222222222222222  
 TOTALS 1122344566788900122344566778899001122233344455566  
 OF CURVE 50627406306307418529529517394959493715825825814703  
 2620913830E766665542960466516909603542837912222234

